

TIMETABLE

TIME	Sun 5	Mon 6	Tue 7	Wed 8	Thu 9	Fri 10	Sat 11	Sun 12	Mon 13	Tue 14	Wed 15	Thu 16	Fri 17
9:00-9:45	.....	Late Reg	A 1	S 3	S 5	C 8	A 8	Bus to Niagara	S 9	S 12	S 16	S 20	CA
9:55-10:40	.....	Welcome Keynote	S 2	A 3	A 5	A 7	C 10		S 10	S 13	S 17	S 21	CA
10:40-11:00	.....						COFFEE						
11:00-11:45	.....	S 1	C 4	C 6	C 7	S 7	A 9		A 11	S 14	S 18	S 22	CA
11:55-12:40	.....	C 1	A 2	S 4	S 6	C 9	A 10		S 11	S 15	S 19	S 23	CA
12:40-2:00	.....						LUNCH						
2:00-2:45	.....	C 2	C 5	A 4	A 6	S 8	C 1		C 1	C 1	C 1	C 1	CA
2:45-3:40	.....	C 3	C 1	C 1	C 1	C 1	C 1		C 1	C 1	C 1	C 1	CA
3:40-4:00	.....	C 1	C 1	C 1	C 1	C 1	C 1		C 1	C 1	C 1	C 1	CA
4:00-5:30	.....	C 1	C 1	C 1	C 1	C 1	Reception		C 1	C 1	C 1	Reception	CA
6:00-7:00	Registration						SUPPER						
7:00	.....	Reception	CA	CA	CA	CA	BREAK		CA	CA	CA	Banquet	

## COURSE DETAILS

- C L — Computer Lab  
C A — Computer Available

## Digital Computers C

Lectures 1 to 6 —Computer organization and languages.

Lectures 7 to 10—Algorithms and simulation, Bus and loop admittance matrix formulation and simulation.

## Numerical Analysis A

Lectures 1 to 4 —Matrix algebra, operations and inversions and transformations and eigenvalues.

Lectures 5 to 8 —Numerical methods for solution of sets of DE's.

Lectures 9 to 11 —Topology and linear graphs. Solution of linear and nonlinear algebraic equations.

## Power Systems S

Lecture 1 —Transmission lines (parameters, differential equations, modeling).

Lecture 2 —Compensation and tuning of transmission lines.

Lectures 3 to 7 —The synchronous machine, dqo, phase models, saturation, dampers.

Lecture 8 —Transformation (symmetrical components, Park,  $\alpha\beta$ , UTO).

Lectures 9, 13 —Feedback controls, prime mover and field excitation transfer functions including static controllers.

Lectures 10, 12, 17—Electrical Transients and Protection. Open and short circuit studies. System travelling waves, solid state protection, accuracy and reliability.

Lectures 11, 14, 15, 20—Mechanical transients, effect of control parameters, swing equations, stability criteria for small and large perturbations.

Lectures 16, 19, 22—Load flow, voltage controlled buses, transformers, tie line control.

Lectures 19, 21, 23—Economic operation, economic dispatch, load frequency control, loss formulae, reactive power dispatch.

# digital computers in power system engineering

6-17 May  
1968

University of Toronto  
Department of  
Electrical Engineering  
and  
Division of Extension

The course is intended for power system engineers, system planners, applied mathematicians, and educators.

## OBJECTIVES

It is anticipated that this course will —

- familiarize the participants with the organization, algorithms, programming, and simulation techniques associated with the digital computer.
- provide the required background of numerical and mathematical methods applicable to the use of digital equipment for active control and problem solving.
- allow evaluation of system models and computational economy when applied to the solution of system transient, planning, control and economic problems.

A sample generation and transmission system will be used to focus the attention of the lectures and problem sessions. The participants will be asked to design and analyze the system in stages as the course proceeds.

## STRUCTURE

An integrated and systematically developed presentation of courses in computer organization, numerical analysis, and power system modeling and analysis as well as associated computer laboratory sessions will be provided.

Allocation of time is on the following basis —

- computer organization and languages — 10 hours

- numerical and mathematical methods — 11 hours
- power system modeling, analysis, and controls — 23 hours
- computer laboratory — 25 hours
- computer free time — 30 hours

## STAFF

Lecturers for the course will include —

Dr. J. M. Undrill, General Electric Co., Schenectady

Professor J. E. Van Ness, Northwestern University

Mr. D. T. McGillis, Hydro Quebec

Mr. P. L. Dondeno, Ontario Hydra

Professor W. Jonischewskyj, University of Toronto

Professor S. D. T. Robertson, University of Toronto

Professor E. S. Lee, University of Toronto

Professor P. I. P. Boulton, University of Toronto

Through the use of assistants a student to staff ratio of 3:1 will be provided during the computer laboratory sessions. There will also be extensive assistance available during the computer free time sessions in order to assist in programming and system problems.

## FACILITIES

IBM 360/50, IBM 1710, and IBM 7094 computers will be available to participants.

WHEN

Classes will be held from May 6 to May 17, 1968. Registration and reception will be on May 5.

WHERE

University of Toronto  
Electrical Engineering Department  
Golbroith Building  
35 St. George Street  
Toronto 5  
Ontario  
Telephone (416) 928-3116

## ENROLMENT

Pre-registration by mail is required. Complete the attached form and return it as soon as possible before April 26. Registration will be limited.

All applications must be sent to:  
Division of Extension  
Business and Professional Courses  
University of Toronto  
84 Queen's Park  
Toronto 5  
Ontario  
Telephone (416) 928-2400

## HOUSING

Accommodation may be arranged for participants on request to the Division of Extension. Separate financial arrangements must be made between the participant and his place of residence.

## ACTIVITIES

Sunday afternoon, May 12, may be spent visiting the Niagoro Hydro generation facilities by those who wish. Some sightseeing will be included and a dinner will be arranged at Niagoro Falls. Receptions and a final banquet will be provided during the course.

## COSTS

The course fee is \$350.00. This will include all notes, materials, computer time, receptions, a banquet, and daily break refreshments. Daily room and board are not included.

# digital computers in power system engineering

Mr. \_\_\_\_\_  
 Mrs. \_\_\_\_\_  
 Miss \_\_\_\_\_  
 NAME (PLEASE PRINT)

Address \_\_\_\_\_  
 NUMBER & STREET  
 CITY \_\_\_\_\_  
 PROVINCE \_\_\_\_\_

Company \_\_\_\_\_  
 Position \_\_\_\_\_

Business Address \_\_\_\_\_  
 Home Telephone \_\_\_\_\_ Business Telephone \_\_\_\_\_

Fee: \$350.00    Cosh ☐    Personal Cheque ☐    Company Cheque ☐

My cheque or money order for the tuition fee in the amount of \$350.00  
 payable to par to the University of Toronto, is enclosed.

Date \_\_\_\_\_ Signature \_\_\_\_\_

R. No. \_\_\_\_\_  
 OFFICE USE

C.A. \_\_\_\_\_

**Send To:**  
BUSINESS AND PROFESSIONAL COURSES  
DIVISION OF EXTENSION  
UNIVERSITY OF TORONTO  
84 QUEEN'S PARK  
TORONTO 5, ONTARIO